V.—*On the Dissociation of the Egg into a Large Number of Distinct Individuals, and the Cycle of Development in* Encyrtus fuscicollis (*Hymenopteron*). By Paul Marchal *.

In insects asexual reproduction may manifest itself at different stages in the ontogeny. Sometimes we find larvæ reproducing by budding forth new larvæ in the interior of their bodies (pædogenesis); sometimes it is a case of adults giving birth to new individuals which develop in the ovaries of the parents (parthenogenesis of the Aphides). We have just discovered in the parasitic Hymenoptera a new mode of reproduction which completes this series of phenomena, of which it constitutes, to some extent, the first step; in *Encyrtus fuscicollis*, which we have been studying, it is, in point of fact, at the outset of the ontogeny, in the egg itself that the dissociation of the body takes place, and it is at the expense of a single egg that we shall see the formation of a very large number of embryos, which may exceed one hundred, and are all destined to become perfect insects which, at any rate as a rule, will be of the same sex.

It had already been observed by M. Ed. Bugnion † that the caterpillars of the *Hyponomeuta* of the spindle-tree might, in the course of June, contain extremely curious chains of parasitic embryos. These chains, only one of which was usually found in each infected caterpillar, were formed on an average of from fifty to one hundred individuals arranged one behind the other, surrounded by a granular mass analogous to a vitellus, and *united in a long common epithelial tube*, which was closed at both ends, and floated in the lymph of the caterpillar by the side of the alimentary canal. Bugnion followed the development of these embryos, and saw that each of them produced a specimen of *Encyrtus fuscicollis*. How and where was the oviposition of the *Encyrtus* performed? Above all, what was the origin and significance of the common epithelial tube enclosing the chain of embryos? These were questions well calculated to excite the curiosity of the naturalist. In the opinion of M. Bugnion the *Encyrtus* hatched in summer hibernated, or produced a second generation, the host of which was unknown; he considered that, at all events, the insect must, during the month of May, deposit

* Translated by E. E. Austen from the 'Comptes Rendus,' t. cxxvi. no. 9 (Feb. 28, 1898), pp. 662–664.

† Ed. Bugnion, "Recherches sur le développement postembryonnaire, l'anatomie et les mœurs de l'*Encyrtus fuscicollis*" (Recueil zoologique suisse, t. v. pp. 435–535, 1891).

its eggs *in masses* in the interior of the caterpillar of the *Hyponomeuta*; as for the epithelial tube, this, according to our author, was derived from the amnions of the embryos, separated secondarily from the latter and united end to end. These conclusions, albeit legitimate enough in appearance, are nevertheless completely at variance with the actual facts.

I have observed the oviposition of *Encyrtus fuscicollis*: now the insect deposits its eggs not in the month of May, but in July, not many days after it is hatched; moreover, it is not in the caterpillar, but in the ova themselves of the *Hyponomeuta* that its eggs are laid. The little Chalcid alights on a batch of eggs and remains there for hours, piercing in succession with its ovipositor all or almost all the eggs of which the batch is composed. I reserve for a subsequent paper the details of this operation, which I have watched for a long period, and content myself with stating that the time necessary for the *Encyrtus* to deposit its egg in that of the *Hyponomeuta* varies between half a minute and two minutes; almost immediately afterwards it passes to another egg of the same batch, and so on in succession for hours at a time; then, when it has finished, it makes its way to another batch, and recommences its proceedings.

One capital fact results from the foregoing observation. Given the limited quantity of eggs contained in the ovaries of an *Encyrtus*, it is materially impossible, in the short time necessary for the process of oviposition, for it to deposit, in each egg of the moth, a number of eggs equal to that of the embryos composing one of the chains of which we have spoken. A single egg must therefore be laid in the egg of the *Hyponomeuta*, and this solitary egg must dissociate itself into a large number of embryos.

This conclusion, which forces itself upon us, is proved by direct observation. I have witnessed the commencement of the development of the egg, and have found that its amnion is at first constituted like that of the other known Chalcids; afterwards, with the rapid multiplication of its cells, it elongates in such a way as to form the epithelial tube. As for the cells lying within the amnion, instead of going to form a single embryo, as is usually the case, they become dissociated in such a way as to give rise to a whole legion of little *morulæ*, which later on will become organized into embryos and will arrange themselves in file, in proportion as the amniotic envelope, increasing in size, passes from the primitive vesicular form into that of a long flexuous tube. The entire product of the segmentation is not, however, devoted to

the formation of the embryos; at the very outset a mass of cells is seen to isolate itself at the periphery, in the shape of a crescent, which gradually increases in size and becomes separated off to form, in all probability, the granular mass which fills the amniotic tube and encompasses the embryos.

The result of the foregoing observation is therefore the discovery of a mode of reproduction which is entirely new among the Arthropoda, and of which it is difficult, I think, to find an equivalent among the Metazoa. Now, how are we to interpret this curious case of metagenesis? Must we consider the tube containing the chain of embryos as a nurse, of which the soma would be represented by the epithelial tube and by the internal cells which do not participate in the formation of the embryos? We cannot help thinking of the Cysticerci and the Orthonectida; but comparisons of this sort would at present be injudicious. We prefer to confine ourselves to the facts, waiting for their general interpretation until the observations which we are pursuing upon different species furnish us with more ample data.

VI.—*Seasonal Dimorphism in Butterflies of the Genus* Precis, *Doubl.* By Guy A. K. Marshall, F.Z.S.

It is now nearly two years since I recorded my conviction (Trans. Ent. Soc. 1896, p. 557) that seasonal dimorphism of a singularly marked character existed among certain African species of the genus *Precis*. This opinion, based as it was on field observations alone and not on actual breeding experiments, did not appear to receive general acceptance; and this is perhaps hardly to be wondered at seeing how very marked are the differences between such forms as *octavia* and *sesamus*, *simia* and *cuama*, *archesia* and *pelasgis*, &c.

The only counter evidence of any importance, however, which has come under my notice is that adduced by that eminent entomologist Mr. W. L. Distant in his interesting notes on Transvaal butterflies (Ann. & Mag. N. H. (7) vol. i. p. 51). He there says, "I found *Precis octavia* var. exceedingly scarce in the Transvaal, having only secured one specimen at Pretoria. I have since received another example from Johannesburg. *P. sesamus*, on the contrary, was very abundant, and always during the wet or summer season, frequenting my small flower-garden. Hence I have found no evidence for the proposition made by Mr. Guy A. K. Marshall that the two species are identical, or, rather, that *P. octavia* is the wet-season and